

# Developing a Framework for Prevention of Childhood Falls in Rural Bangladesh: Implication for Low-Income Countries



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## ABSTRACT

Childhood falls and their complications are a major public health problem in Bangladesh as in other parts of the world. However, the problem was not recognized and systematically studied earlier. A holistic approach considering the socio-economic and cultural context is needed to address this problem. Adequate information about the magnitude, associated factors and community perceptions (both parents and children) about the problem is necessary in order to design a community-based intervention. This thesis attempted to determine the magnitude of the problem, epidemiological features, socio-economic and cultural associations and community perceptions about childhood falls. Finally a framework is proposed to address childhood falls in rural Bangladesh. Five studies were carried out in this dissertation. Data from the Bangladesh Health and Injury Survey (BHIS) were used for two of these studies. Two qualitative studies were also conducted in two different rural settings.

The first study enabled us in calculating the magnitude of unintentional injuries among children as well as comparing the burden of injury morbidity focusing on falls with other causes of illness. Falls was the leading cause of morbidity among 5-9 years children. This study also revealed that around 57 percent of all falls occurred in the home and its surroundings.

The second study determined the incidence of childhood falls and associated factors. The yearly incidence of falls among children less than 18 years was 472.9/100,000 children per year. The incidence of childhood falls was significantly higher among male children. Home and its surroundings were identified as the most common places of incidence. It was also revealed that more than half of all incidences occurred from height.

The third study investigated the parents' perception as well as time, place and causes of unintentional injuries among children. This study also documented common injury prevention practices in the community by the parents. Young children were found to be the main victims and the majority of all unintentional injuries occur in the home and its surroundings. In few households it was observed that safety measures are being practiced by the parents unknowingly. Supervision and placing barriers were suggested as the main preventive measures. Using mass media and government involvement were also suggested.

The fourth study aimed at obtaining views of Bangladeshi rural children about childhood falls and their prevention. It was found that boys appeared to be the main victims of falls and that the majority of these injuries occurred in and around the home. It was also documented that children mostly sustained injury when they were unsupervised. Supervision, public awareness and placing barriers at the door were suggested as the preventive measures.

The fifth study describes the framework for childhood falls prevention in rural Bangladesh. The framework has been developed through series of workshops by utilizing the findings of above studies and compiling findings of similar studies following extensive literature review.

In conclusion, the thesis illustrated the high incidence of childhood falls in rural Bangladesh. The thesis explored the common causes of unintentional injuries among children and the focus was on childhood falls. The thesis also documented parents' and children's perception about unintentional injuries especially falls among rural Bangladeshi children and its prevention. Based on all this information a framework for childhood falls prevention was developed for rural Bangladeshi children which could be replicated in other countries with similar socio-cultural settings.

Key words: falls, children, rural, prevention, low income countries.

## LIST OF PUBLICATIONS

- **Salim Mahmud Chowdhury**, Aminur Rahman, Saidur Rahman Mashreky, Sheikh Giashuddin, Sumona Shafinaz, Leif Svanström, Lars-Gunnar Hörte, AKM Fazlur Rahman. The horizon of unintentional injuries among children in low-income setting: an overview from Bangladesh Health and Injury Survey. *Journal of Environmental and Public Health*. Volume 2009, Article ID 435403, 6 pages, doi:10.1155/2009/435403.
- **Salim Mahmud Chowdhury**, Aminur Rahman, Saidur Rahman Mashreky, Sheikh Giashuddin, Leif Svanström, Lars-Gunnar Hörte, Michael Linnan, Sumona Shafinaz, Iyorkumun J Uhaa, AKM Fazlur Rahman. Childhood fall: Epidemiological findings from a population based survey in Bangladesh. *International Journal on Disability and Human Development*. 2008; 7(1): 81-87.
- **Salim Mahmud Chowdhury**, M A Halim, Leif Svanström, Lars-Gunnar Hörte, AKM Fazlur Rahman. Parents' perception about unintentional childhood injuries and its prevention in rural Bangladesh: a qualitative study in a local community. *International Journal on Disability and Human Development* (special issue on rural health). 2009; 2(2):195-202.
- **Salim Mahmud Chowdhury**, Leif Svanström, Lars-Gunnar Hörte, Rabiul Awal Chowdhury, Fazlur Rahman. Children's perception about falls and its prevention: a qualitative study from a rural setting in Bangladesh. *BMC Public Health*. 2013; 13:1022 (doi:10.1186/1471-2458-13-1022).

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## **LIST OF ABBREVIATIONS**

BHIS	Bangladesh Health and Injury Survey
BUET	Bangladesh University of Engineering and Technology
CI	Confidence Interval
CIPRB	Centre for Injury Prevention and Research, Bangladesh
DALYs	Disability Adjusted Life Years
DGHS	Directorate General of Health Services
DMC	Dhaka Metropolitan City
ECD	Early Childhood Development
FGD	Focus Group Discussion
HIC	High Income Country
ICDDR	International Centre for Diarrhoeal Disease Research, Bangladesh
ICMH	Institute of Child and Mother Health
IDI	In-Depth Interview
LIC	Low Income Country
MIC	Middle Income Country
PRECISE	Prevention of Child Injuries through Social-intervention and Education
RTIs	Road Traffic Injuries
SPSS	Statistical Package for Social Sciences
TASC	The Alliance for Safe Children
U5MR	Under 5 Mortality Rate
UNICEF	United Nations Children's Fund
WHO	World Health Organization





## 1. INTRODUCTION

Unintentional injuries have been recognized as one of the leading causes of death among children and young adults globally [1], responsible for about 950 000 deaths in children and young people under the age of 18 years each year [2]. The vast majority of child injuries are unintentional injuries such as road traffic injuries, falls, burns, drowning and poisoning [3]. During the past few decades falls have been recognized as a major cause of disability throughout the world and responsible for substantial morbidity among children of all ages [1]. Globally, approximately 50% of the total numbers of disability-adjusted life years (DALYs) for <15 years of age are due to falls [4]. In most countries, falls are the most common type of childhood injury seen in emergency departments, accounting for between 25% and 52% of assessments [5,6]. Magnitude of falls like other unintentional injuries varies according to the age, sex, region, income group and cultural background [7,8]. Most of the child injuries due to falls occurred in and around the home [9]. School-based injuries surveillance in Pakistan confirmed that falls while playing are the commonest injury mechanism [10].

A recent epidemiological study from Bangladesh established falls as the 4th leading cause of morbidity after infancy and rural children were found to be at great risk [11]. Another study on medical help-seeking behaviour in Bangladesh has also shown that falls comprised one-third of total childhood injuries and falls from trees were the main cause of hospital admission due to trauma among children [12]. Falls are one of the major causes of permanent disability in children, disabling 10 children each day in Bangladesh [13].

Injury can be prevented through a range of approaches especially educational, environmental, and legislative approaches [14]. The grave prominence of childhood injuries calls for dire attention from the public health community. Yet, current public health systems are not prepared to respond to this area of child health. This gap signifies an opportunity to address the prevention of mortality and morbidity among children from injuries.

There is a dearth of publication on the epidemiology of childhood falls and their prevention in Bangladesh. Valid hospital and community-based data is another hindrance in addressing childhood falls in Bangladesh. This research was therefore undertaken to explore the epidemiological aspect of childhood unintentional injuries, especially falls. In addition, socio-cultural issues related to perception of injuries by the parents and children as well as their suggestions for addressing injuries were documented. Finally, a potential framework to address childhood falls for rural Bangladesh was developed, which is expected to be effective in reducing childhood mortality and morbidity due to falls.

## **2. BACKGROUND**

Injury is a significant cause of death and morbidity among children from the age of one and increases to become the leading cause of death among children aged 10 to 19 years. A global estimate shows that nearly 47 000 children and youth under the age of 20 years died as a result of a falls in 2004. Low-income and middle income countries of the Eastern Mediterranean and South-East Asia Region of World Health Organization (WHO) have the highest rate of falls related death globally [15]. Findings from a global study conducted in four cities shows that falls were twice as common as road traffic injuries and the most common cause of injury (58.6%) among children visiting the emergency department [16]. The median incidence of fall injury in Asia in those aged 0-18 years was found to be 170 per 100 000 children averaging 43% of all injuries [3]. The UNICEF (United Nations Children Fund) -TASC (The Alliance for Safe Children) surveys have also found falls as a leading cause of morbidity and disability among children [17]. The distribution of fall-related injuries is unequal with respect to socio-demographic and economic status [5].

### **2.1 Perspective and Situation of Childhood Falls**

Injuries have traditionally been regarded as random, unavoidable events. Falls are normal phenomenon during a child's development - learning to explore the surrounding environments, walking, running, climbing and jumping [15]. The following are the determinants, which have varying degrees of relationship with the risk of childhood falls:

Demographic factors: Young children are the most vulnerable group for unintentional injuries. Their physical and cognitive abilities, degrees of dependence, activities and risk behaviours all change substantially as they grow older [18]. As children develop, their curiosity and wish to experiment are not always matched by their capacity to understand or to respond to danger. Child development and behaviour is highly associated with injuries, especially with falls.

Incidence and severity of childhood falls related injuries are high between 5 and 12 years [19]. A study from Greece found that almost two thirds of all injuries recorded among infants were due to falls [20]. Falls were a leading cause of death among the infants in the Islamic Republic of Iran [21]. In Uganda it was found that falls were the most common cause of severe injuries in children < 10 years of age [22]. A global study shows that most falls occurred in boys > 5 years of age [16]. According to the WHO, boys are overrepresented in falls mortality statistics [15]. A population-based study in Bangladesh also revealed that falls are significantly higher among boys [11]. Fatal falls are significantly higher among infants in Bangladesh [13].

Environmental factors: The home and its surroundings are the most common places for injury incidence among children [13]. A nationwide survey in Singapore showed that the home is the most common place for injury occurrence, followed by outside the home and in schools [23]. A population-based survey in Bangladesh found that home was the most frequent place of childhood falls and around 57% of childhood falls occurred at home and its surroundings[11]. Falls predominantly occur in rural and remote areas rather than in densely populated urban areas [21]. A hospital-based study that confirms most child injuries due to falls occurred around the home while playing [24]. 66% of fatal falls among children occur from a height, while 8% were the result of falls on the same level [15]. Most of the falls from height occurs from trees, roof top and playground equipment.

Socio Economic factors: There is considerable evidence of inverse relationship between socioeconomic status and childhood injury morbidity and mortality [25]. Injury morbidity and

mortality among children are strongly associated with factors such as poverty, single parenthood, low maternal education, poor housing, large family size and parental drug and alcohol abuse [26]. Most of the childhood injury burden rests in low-income and middle-income countries, and within these countries, poor children are disproportionately affected [27]. It was found in the United Kingdom that children from the most deprived background have six times risk of dying from falls than the well-off [28], while several Swedish studies established considerable variations in socioeconomic disparities considering various types of falls [29].

Associated factors that make children susceptible to falls: Young children may fall from heights in the process of exploring their world because their climbing ability is not matched by their ability to balance or reason [30]. Children mostly fall when they are unsupervised. Some studies from Bangladesh show that young children commonly fall at times when their parents are absent, mostly during the mornings and at noon when their parents remain busy with their daily activities [13].

- Fatal falls are more frequent among infants;
- Children aged five to twelve years tend to have both more frequent and more severe injuries due to falls than other children;
- Boys are more vulnerable than girls in terms of frequency and severity of falls related injuries;
- Most common places for childhood falls are home and its premises;
- Childhood falls from height is a determining factor for fatal outcome;
- Falls are more common among rural children; and
- Supervision is a determining factor for childhood falls.

## 2.2 Bangladeshi Studies

Data from the Demographic Surveillance System of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) shows a growing proportion of child deaths due to injuries [31]. In Bangladesh, childhood falls are the leading cause of morbidity (275 600 per year) and disability (3 800 per year) due to injury among children under 18 years [13]. A population-based survey revealed that rates of mortality and morbidity due to injury among children of under 18 years were 43.8 per 100 000 children years and 1542.2 per 100 000 children years respectively [32]. Falls has been identified as the 4th leading cause of morbidity after infancy and were responsible for 8.6% of all causes of morbidity in another study [11]. Falls are the leading cause of non-fatal injury and more than 770 children aged below 18 years injured each day in Bangladesh. Falls is the leading cause of injury related mortality among infants [13]. A study on medical help-seeking behaviour of the injured victims in Bangladesh has shown that falls comprised one-third of total childhood injuries and falls from trees were the main cause of hospital admission due to trauma among children [12].

- In Bangladesh, childhood falls is the leading cause of injury related -
- mortality among infants;
  - morbidity and permanent disability; and
  - hospitalization

### 2.3 Rural Bangladesh Context and Childhood Falls

Topographically, Bangladesh is a plain land except the hills regions of east and northeast. About 80% of the land is flat, intersected by numerous rivers and their distributaries. Bangladesh is primarily a rural culture, and the gram or village is an important spatial and cultural concept even for residents of the major cities. In rural Bangladesh, a mother has more than 2 young children in most cases. Mothers are supposed to do all household activities and usually they do not have housemaids. Newborns and infants are left unattended or supervised by elder siblings when mothers are busy with housework e.g. cooking, washing etc. There are no day-care centres in rural Bangladesh to look after children during the busy times. Parents do not buy playpen-like safety equipment for their children due to poverty. Children fall from their beds and cots or slip from the lap of another child. There is a universal practice of keeping the infant in the same bed as the mother and father in rural Bangladesh. There are many benefits from bed-sharing in developing countries like Bangladesh, such as increased breast feeding rates. However, it also increases the risk of falls and suffocation. Most children begin school at age five or six, and attendance tends to drop off as children become more productive within the household (female) and agricultural economy (male). Children push each other when playing football and other rural Bangladeshi games for the boys (Ha-du-du, dariabanda etc.) and girls (lafdori, gollachut etc.) as well as jumping from trees at the time of bathing in ponds. Most of the rural roads are uneven which increases the risk of falling for the younger children. Hence, the chance of sustaining injury due to falls among rural Bangladeshi children is very high. Management of injuries due to falls among children is also a challenging issue, as in other developing countries due to the huge burden compounded by lack of facilities available in the hospitals. Government infrastructures, especially community health workers, lack of adequate knowledge on childhood falls and their prevention as well as low literacy rates preclude effective prevention programmes. Moreover, people prefer to go to the traditional healer for the treatment especially for fracture following injury.

- In rural Bangladesh, a mother has more than 2 young children in most cases. New-borns and infants are left unattended or supervised by elder siblings when mothers are busy with housework e.g. cooking, washing etc.
- There are no day-care centres in rural Bangladesh to look after children during the busy hour.

### 2.4 Prevention

Prevention of childhood injuries is of great importance to both individuals and society, but unfortunately, it has largely been either excluded from attention or treated in an inappropriate manner. It is well established that identification of the context and mechanisms of injury, including injury risks and hazards, are an essential part of the injury prevention knowledge base [33]. Countries that have achieved the greatest gains in child injury prevention have implemented a combination of multi-sectoral strategies. Interventions to prevent unintentional injuries have traditionally been considered in terms of the "three E's": education, enforcement of law and environmental modification - and within the framework of the Haddon matrix [34]. It is important to have long-term strategies, effective and focused leadership, collaboration between ranges of agencies, appropriate targeting and sufficient time to develop local networks and programmes [35]. There is some evidence that the WHO Safe Communities model is effective in reducing injuries in whole [36]. Modern injury prevention efforts are grounded in a public health approach which considers injury as the product of interactions between an individual, the agent or object that causes injury and the physical and social environment.

## **2.5. Justification of the Study**

Falls are common at some stages of childhood and are almost everyday occurrences. According to the World Health Organization, over 46 000 children died due to falls globally in 2004 [15]. However, falls are the leading cause of unintentional injury for children, accounting for more than one-fourth of non-fatal injury related hospitalizations. Falls-related morbidity represents a significant burden in health care facilities around the world, especially in low-income countries. Frequency of injury, health care cost at the individual, societal and national level and significant risk of long-term disability and deaths demand falls prevention activities as part of child survival programme globally.

As in other countries of epidemiological transition, a gradual shift in the cause of child deaths from infectious diseases to non-communicable diseases and injuries has been observed in Bangladesh [37]. Data from the Demographic Surveillance System of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) shows a growing proportion of child deaths due to injury [13]. A national survey focusing on health and injury revealed that childhood falls were the leading cause of morbidity and disability among children under 18 years of age. A recent study revealed that falls comprised one-third of total childhood injuries and falls from trees were the main cause of hospital admission due to trauma among children [16]. A national survey revealed that falls is the leading cause of injury related death among infants.

Under-Five Mortality Rate (U5MR) for Bangladesh in 1990 was 139, while in 2011 it decreased to 46 only. This improvement is due to successful immunization programme throughout the country. Each year over 30,000 children die of injuries; and half of these children are under five years of age [13]. However, most of the child health programs in Bangladesh are focused on prevention of infectious and nutritional causes of child death. During the last few years, a number of small-scale child injury research projects have been carried out by various institutions -Centre for Injury Prevention and Research, Bangladesh, Accident Research Centre at Bangladesh University of Engineering and Technology (BUET), Centre for Health and Population Research (icddr,b) and Institute of Child and Mother Health (ICMH).

The quantitative part of this research was needed to characterize the epidemiology of injuries focusing on childhood falls using data from a large, nationally representative, community-based sample. However, the qualitative part was designed to explore community perception (parents and children) about childhood injuries, focusing on falls and to acquire their suggestions in addressing this problem. Finally, findings of both parts and the literature review would be used to develop a potential framework in reducing childhood falls for rural Bangladeshi children, which is expected to be effective in reducing childhood mortality and morbidity due to falls.

### 3. AIM AND OBJECTIVES

The main aim and objectives of the study were to

- provide an insight to the policy makers about the magnitude and associated factors of falls among children under 18 years in Bangladesh; and
- develop a strategic framework in reducing falls for rural Bangladeshi children whilst considering a low-income country perspective.

The specific objectives of the study were to

- assess the magnitude of unintentional injuries among children in Bangladesh;
- investigate the epidemiology of childhood falls in Bangladesh;
- gain an in-depth understanding of people's perceptions of childhood injuries focusing on falls and their prevention in rural Bangladesh;
- explore perceptions of rural Bangladeshi children about childhood falls and their suggestions for prevention; and
- develop a community-based potential framework in addressing falls among rural Bangladeshi children considering a low-income country setting.

#### 3.1 Summary of Study Area, Objectives and Study Designs

Papers	Data Source	Objectives	Study Design
I	Bangladesh Health and Injury Survey 2003	Exploring the magnitude and associated factors of unintentional injuries among children	Cross-sectional survey
2	Bangladesh Health and Injury Survey 2003	Determining the magnitude and associated risk factors of childhood falls	Cross-sectional survey
3	Qualitative survey in 4 villages of Raigonj sub-district of Sirajgonj district	Ascertaining parental knowledge regarding common childhood injuries and their preventive practices in rural Bangladesh	Qualitative study
4	Qualitative survey in 5 villages of Bajitkhila union of Sherpur district	Gaining in-depth information about children's perceptions about falls and their risk taking behaviour	Qualitative study
5	Studies conducted under this PhD programme, available literature in the internet and technical inputs from the experts	Developing a framework of falls prevention for rural Bangladeshi children considering a low-income country context	Literature review and consultative workshop

## 4. MATERIALS AND METHODS

### 4.1 Study Settings

#### 4.1.1 Basic information about Bangladesh

Bangladesh emerged as an independent and sovereign country in 1971 following a nine-month war of liberation. It is located between 20°34' and 26°38' north latitude and between 88°01' and 92°41' east longitude surrounded by India to the north and west, by Myanmar to the east and to the south by the Bay of Bengal. It is one of the largest deltas in the world with a total area of 147,570 sq. km with more than 700 km long coastlines. With a unique communal harmony, Bangladesh has a population of about 161 million (2012 estimate). Islam is the largest religion of Bangladesh; almost 75% of the population lives in rural areas. The economy is mostly agrarian. The crude death rate is 6.08 per 1,000 population (World Bank Report, 2012), infant mortality rate is 43 deaths per 1,000 live births and the under-five mortality rate is 53 per 1,000 live births per year respectively. The crude birth rate is 22.6 per 1,000 populations and life expectancy at birth is 65.4 years. Dhaka is the capital city of the country. The country is divided in seven (7) divisions, 64 districts and 493 upazilas (sub districts).

#### 4.1.2 Study areas

This thesis comprises of five studies. Study I and II were prepared using the data of the Bangladesh Health and Injury Survey (BHIS). Under BHIS, quantitative data were collected from the 12 districts of Bangladesh (Thakurgaon, Sherpur, Sirajganj, Narshingdi, Habiganj, Comilla, Cittagong, Rangamati, Pirojpur, Khulna, Jeshor, Shariatpur) and Dhaka metropolitan city (Figure 1). Study III was conducted in Rajshahi sub-district of Sirajganj district, around 200 km from the capital city Dhaka. 4 villages of Bajitkhila union (lowest administrative unit) of Sherpur Sadar upazila (sub-district), Sherpur district were selected for study IV. The fifth study was based on expert opinion, literature review and findings of other papers and studies conducted under this thesis.

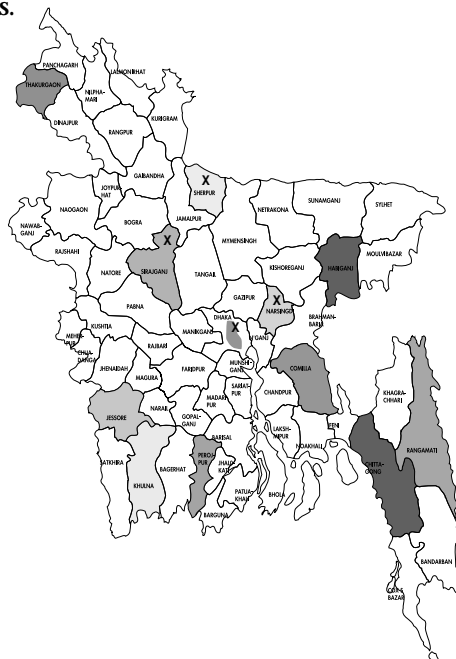


Figure 1: Study areas of Bangladesh Health & Injury Survey (colour areas)



#### 4.2.2 Study III

##### Study design

This study was a qualitative investigation of the parents' perceptions about the risk factors that may contribute to the occurrence of childhood unintentional injury and of their prevention practices. Participants were selected purposively from the rural Bangladesh who had participated in focus group discussions (FGDs) and individual interviews [38,39]. Structured observations were conducted in the families having children under five years of age [40,41].

##### Respondents

Four focus groups were included in the study: two groups of mothers and two groups of fathers. In addition, ten other parents (either mother or father) of different professions and religious groups were interviewed and five focused observations were conducted for the study. The number of respondents in each focus group ranged from 8 to 12. The study was conducted in the Raigonj sub-district of Sirajgonj district.

##### Research instrument

A checklist comprised of a series of prompts was used to collect data. Prompts were finalized by the authors after vigorous field testing.

##### Data collection procedure

Two trained teams conducted the FGDs. Each team consisted of one facilitator, two note-takers and one organizer. The discussion sessions were carried out during November and December, 2006. In each session the facilitator requested one of the participants to tell an unintentional child injury event that s/he had observed or heard about. This story telling was an ice-breaking exercise as well as a thought provoking instrument for the participants. The facilitator then progressively introduced the series of prompts to explore the desired information. Each session was audio-taped with the respondents' permission. A semi- structured check list was used for the in-depth interviews. Structured observations were conducted in the families having children under five years of age for 8 hours, from 8 am to 4 pm, with the prior permission of the residents. The investigators supervised all the sessions. Facilitators conducted the interviews and the focus group discussions in Bengali.

#### 4.2.3 Study IV

##### Study Design

This study was a qualitative investigation of the rural Bangladeshi children's perceptions about falls and their risk-taking behaviour, and their suggestions for prevention. Participants for this study were selected randomly considering gender variation stratified by school and non-school going children. Two different qualitative tools were used for this study - In-Depth Interview (IDI) and Focus Group Discussion (FGD) [38,39]. A guideline (with prompts) was developed to follow the process and relevant probing considering grounded clues or questions.

##### Respondents

It was evident that a child's self-reported participation in decisions concerning his/her own spending and activities increases sharply between ages 10 and 14 years [42]. Therefore children of 10-17 years from the selected villages were included in our study from 4 villages of Bajitkhila union, Sherpur Sadar upazila, Sherpur district. Six focus groups were included in the study - three groups of boys (two groups of school going boys and one group of non-school going boys) and three groups of girls (two groups of school going girls and one group of non-school going girls). FGDs were conducted in three villages out of selected five villages. Two FGD (one boy's and one girl's) were conducted in each village. In-depth interviews were conducted in all selected villages (one boy and one girl in each village).

## **4.2 Methodology of each Study**

### **4.2.1 Study I and Study II**

#### **Study design**

A cross-sectional survey was conducted during the year 2003 (January to December) as part of the Bangladesh Health and Injury Survey.

#### **Study population**

A multi-stage cluster sampling was used to choose a total sample size of 171,366 households; 88,380 from rural areas, 45,183 from district towns (urban areas) and 37,803 households from Dhaka Metropolitan City. This encompassed a population of 819,429 including 351,651 children under 18 years of age.

In Bangladesh there are 64 districts. A total of 12 districts were chosen by simple random sampling. Each district comprises of several upazilas (sub-districts). One upazila was randomly selected from each selected district. Each upazila comprises a number of unions. A union is the lowest administrative unit comprising of ~ 20,000 population. From each upazila two unions were selected randomly and each union was considered as a cluster. All households in the union were included in the survey. The district headquarters of the 12 selected districts and Dhaka Metropolitan City constituted the urban areas. In the urban areas, mohallas (a mohalla is the lowest unit in an urban area) served as clusters and systematic sampling was performed to achieve the required number of households. However, Dhaka Metropolitan City was selected purposively.

#### **Case ascertainment**

There is no universally agreed age range for what constitutes childhood - a concept that varies considerably across cultures. For our study we used the definition of a child specified in the Convention on the Rights of the Child (68), and thus focus on unintentional injuries occurring in children "under the age of 18 years". Children were identified as an injury case when s/he had any treatment or could not perform normal activities for at least three days due to injury.

#### **Data collection and Interview**

Forty-eight data collectors collected data from respondents using face to face interviews. Along with the researchers, six full time supervisors were employed for the supervision and monitoring of the data collection process. Mothers were primarily preferred as respondents. However, if the mother was not available the most knowledgeable members of the household were considered as respondents. Where possible, the head of the household and as many members of the household as possible were present to corroborate or add detail to the respondents' interview answers. Screening forms were used to identify any mortality or morbidity in the household. A household member was defined as a member living in the same house, including domestic helpers, long term guest etc., sharing meal and information.

The respondents were first asked whether any deaths had taken place in the household in the last two and three years in National and Dhaka metropolitan survey respectively, or if there had been any illness in the last 6 months. If any deaths or illnesses were identified, the interviewer proceeded to obtain further information regarding the death or illness. Structured questionnaires were employed if there was death or illness due to unintentional injuries. Repeat visits were made to the household where respondents were unavailable in first visit. Despite repeated attempts, 2.7% households could not be interviewed. A total of 166,766 households participated in the study.

#### Research instrument

The interview tools were developed based on a literature search and expert opinions on prevalent risk factors for childhood falls. Experts reviewed the tools before pre-testing concerning the scope and coverage of the study. This range of tools allowed for the triangulation of findings, thus enhancing the interpretation of the data and facilitating our ability to validate information as the study evolved. Extensive training was conducted for the junior research fellows (anthropologists) on the use of the final tools after necessary correction following pre-testing. A free flow of opinions and conversation was encouraged for the study.

#### Data collection procedure

The focus group discussions with the children were conducted at resident premises with 8 to 10 respondents in each group. In selecting respondents preference was given to those who had heard of or seen any falls-related event but it was not mandatory. One trained team consisting of one facilitator, two note-takers and one organizer were deployed to conduct the FGDs. After welcoming participants in each session during FGD, the facilitator gradually introduced a series of prompts to explore the desired information. Each session was audio-taped with the respondents' permission. A guideline was used for the in-depth interviews. Before the interview or discussion, the aims of the study were explained to the participants as well as to their parents, confidentiality guaranteed, and permission asked to record the interview, thus verbal recorded consent was obtained. The study was carried out during July and August, 2010. Facilitators conducted the interviews and the focus group discussions in Bengali.

#### 4.2.4 Study V

This final study was designed to develop a potential framework of falls prevention for rural Bangladeshi children considering a low-income country context through series of consultative workshops. Findings of all research works under this thesis were analysed and key findings were summarized which were used as the knowledge base in developing childhood falls prevention framework. Moreover, available published literatures focusing on childhood injuries especially falls and its prevention in context of low-income countries were reviewed.

#### Process of literature review

A systematic PUBMED (<http://www.ncbi.nlm.nih.gov>), search of the literature published between 2000 and December 2012 was conducted to retrieve data on unintentional child injuries focusing on falls and its prevention in low-income countries. Non-legislative interventions aimed at primary or secondary prevention of childhood falls at home and its premises were reviewed. Combinations of following keywords were used: falls, injury, childhood, low-income countries and prevention. The search was extended by using the 'related articles' link on PubMed. During review of the articles, additional papers were identified from the respective reference lists; and a manual search of journals was also done. Only articles published in English or at least with an English abstract were considered for review.

A search for accessible web-based data was also conducted through the search engine Google (<http://www.google.com>) and selected websites such as the World Health Organization ([www.who.int](http://www.who.int)) and The Cochrane Library (<http://onlinelibrary.wiley.com/cochranelibrary/search>). A search for reports of country-based or nationally representative samples in such 'grey' literature was also undertaken.

Following literature review relevant information on good practices and effective childhood falls prevention activities were documented. Findings were presented during the consultative workshops along with the findings of other research works under this programme as the baseline information in outlining the framework.

#### Organizing workshops

Series of consultative workshops were conducted at national level. Participants of these workshops were mainly from the health and social sectors; either they were subject specialists or programme specialists.

### **4.3 Data Analysis**

#### Study I

Standard descriptive statistics were used to analyse the characteristics of unintentional injuries. The incidence was calculated with exact binomial 95% CI (Confidence Interval). Relative Risk (RR) was calculated to compare the risk of unintentional injuries in different place of incidence and sex by using a two by two table in EPI info software. Top ten leading causes of morbidity for different age groups were also tabulated to show the burden of childhood unintentional injuries.

#### Study II

To characterize falls, standard descriptive statistical methods were used. Means, standard deviations (SD) and proportions were used as appropriate. Burden of childhood falls in comparison to other causes of morbidity/illness stratified by age groups were also tabularized. The incidence was calculated with exact binomial 95% CI. Differences were considered significant level of probability at exact level.

#### Study III

Transcripts from the audiotapes were prepared and then analysed by examining the transcripts and note-takers' notes in detail to identify the range of ways in which the participants responded to various unintentional childhood injuries and their preventive measures. After sorting and categorizing the responses, excerpts from the transcripts were chosen to illustrate the summary statements, which were also used to validate the findings [43].

#### Study IV

Transcripts from the audiotapes were prepared and then analysis was performed by examining the transcripts and note-takers' notes in detail to identify the range of ways in which the participants responded to childhood falls and their preventive measures. Major themes were identified, coded and categorized using content analysis [43].

#### Study V

Study five was the framework for the childhood falls prevention programme for rural Bangladesh. The methodologies used in this study were literature review, workshops and meetings. Therefore, no statistical analysis was carried out for this study.

### **4.4 Ethical Considerations**

Informed consent was obtained from all respondents before collecting data. Respondents were assured that the data would only be used for research purposes and all answers would be confidential. Consent was also obtained for taking photographs and making audio recordings. For the study I and II ethical permissions were obtained from the Ethical Committee of the Institute of Child and Mother Health, Dhaka, Bangladesh. For the study III and IV ethical clearance was obtained from the Ethical Committee of the Centre for Injury Prevention and Research, Bangladesh.

## 5. SUMMARY OF MAIN RESULTS

### 5.1 Study I

During the study period 5577 cases of unintentional injuries in children aged 17 years or less including 154 fatal cases were identified. Common causes of injuries among these children were falls (n = 1663; 29.8%), burns (n = 1013; 18.2%); injuries by sharp cutting object or cut injury (n = 743; 13.3%); road traffic injuries (RTI) (n = 675; 12.1%); drowning/near drowning (n = 495; 8.9%); animal bites (n = 361; 6.5%) and electrocutions (n = 277; 5.0%) (Table1).

Table 1. Top ten leading causes of morbidity among children (<18 years)

Rank	<1 Year	1-4 Years	5-9 Years	10-14 years	15-17 Years	1-17 Years
1	ARI/Pneumonia (848)	ARI/Pneumonia (1686)	Falls (582)	Fever (505)	Fever (238)	ARI/Pneumonia (2668)
2	Diarrhoeal Diseases (381)	Diarrhoeal Diseases (1287)	Fever (555)	Falls (447)	Falls (169)	Diarrhoeal Diseases (1937)
3	Malnutrition (97)	Burns (580)	ARI/Pneumonia (508)	ARI/Pneumonia (334)	ARI/Pneumonia (140)	Fever (1857)
4	Fever (94)	Fever (559)	Diarrhoeal Diseases (352)	Cut injuries (216)	Road traffic injuries (128)	Falls (1600)
5	Falls (53)	Falls (402)	Burns (267)	Diarrhoeal Diseases (210)	Cut injuries (94)	Burns (979)
6	Skin Disease (49)	Malnutrition (301)	Measles (264)	Measles (200)	Diarrhoeal Diseases (88)	Measles (828)
7	Measles (37)	Near drowning (297)	Cut injuries (261)	Road traffic injuries (188)	Measles (80)	Cut injuries (714)
8	ARI and Diarrhoea (36)	Measles (284)	Road traffic injuries (228)	Skin Disease (151)	Jaundice (75)	Road traffic injuries (651)
9	Burns (35)	Skin Disease (216)	Asthma (132)	Animal bites (125)	Malaria (57)	Malnutrition (531)
10	Meningitis (25)	ARI and Diarrhoea (157)	Malnutrition (125)	Jaundice (117)	Burns (42)	Skin Disease (500)

The rate of fatal and non-fatal injuries among children of under 18 years were 43.8 per 100,000 children years and 1542.2 per 100,000 children years respectively. Drowning was the leading killer of children over 1 year of age and falls was the leading cause of morbidity among 5-9 years children. The incidence of unintentional injuries was significantly higher among boys (2074.8 per 100,000 children-year; 95% CI = 1994.9 - 2157.8) than girls (1025.6 per 100,000 children-year; 95% CI = 968.7 - 1085.8). Additionally, it was observed that the incidence rate of injuries among rural children (2177.1 per 100,000 children-year; 95% CI = 2099.0 - 2285.1) was significantly higher than the urban children (843.9 per 100,000 children-year; 95% CI = 789.7 - 909.1). Home and its surroundings were the most common place for injury incidence. Most of the children who sustained injuries were involved in indoor playing (23.4%) at the time of incidence followed by working in the agriculture field (20.9%), outdoor playing (20.2%) and travelling (13.8%). During the study period 74 cases of severe injury i.e. permanent disability were identified with an incidence rate of 21 per 100,000 child-years.

**Key findings:**

- Falls is the 4th leading cause of morbidity among children of 1-17 years
- Boys are more vulnerable than girls
- Home and its premises is the main place of incidence

## 5.2 Study II

In the survey it was found that 1663 children were victims of falls, and 10 of them died. The Incidence of childhood falls was 472.9 per 100,000 children years among all children. However, the rates of fatal and non-fatal falls among children under 18 years were 2.8 per 100,000 children years and 470.1 per 100,000 children years respectively. Among the total non-fatal fall, 69% were male and 31% were female. Falls were the 4th leading cause of morbidity after infancy and were responsible for 8.6% of all causes of morbidity. Incidence of childhood fall was found to be significantly higher among boys than girls (642.8 vs. 298.2 per 100,000 children year) (Figure 2). Most of the childhood falls were identified in the rural areas.

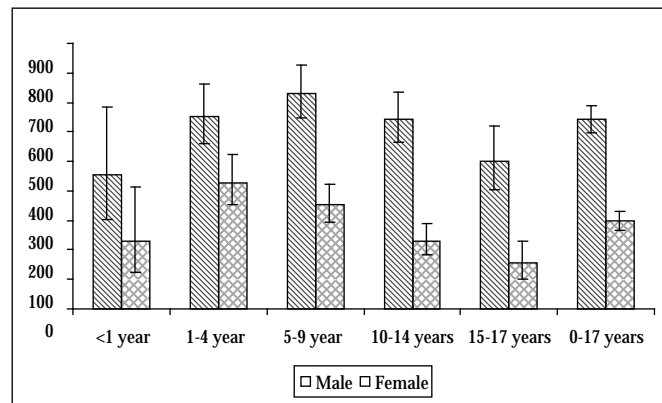


Figure 2: Incidence rate (per 100,000) of childhood fall (<18 years) by age and sex

In this study, we also found that the home was the most frequent place of childhood falls. Around 57 % of childhood falls occurred at home and its premises. Highways/street, sports areas, schools and other areas were found to be the other common sites where various proportions of childhood fall occurred (Figure 3)

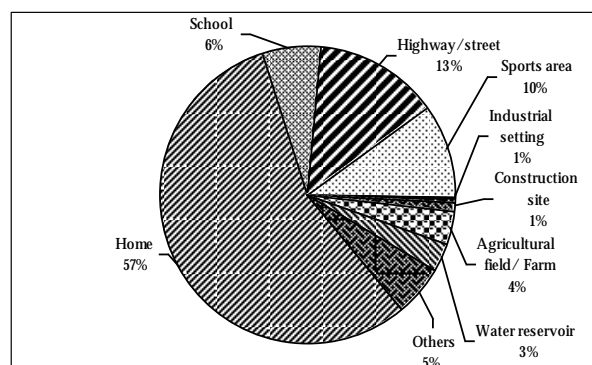


Figure 3: Distribution of childhood falls (<18 years) according to the places of occurrence

It was revealed that more than half (56%) of all incidents occurred from heights, and trees (32.4%) were found to be the most common sites, followed by furniture. 34% of falls which took place at the same level happened when the children were engaged in sports.

**Key findings:**

- Incidence of childhood falls was 472.9 per 100 000 children years
- Incidence is significantly higher among male children
- Home and its surroundings is the most common place of incidence
- More than half of all incidents occurred from heights, trees being a common location

### 5.3 Study III

The study results showed that injury prevention was not identified as a high priority in parenting; mothers were mostly concerned about other health problems of their children. Most of the respondents did not believe that injuries could be prevented. It is perceived that their attitudes consider these events as part of the normal process of a child becoming an adult. The study also revealed that mostly younger children were the victims of injury, though only a few mentioned that older children were more vulnerable. However, it was also observed that injuries appeared as an alarming event in the older age groups. Thus, there was no consensus in this regard among the participants. Home and its surroundings were found to be the most common site of child injuries. From this study it was evident that parents believe injuries predominantly happen without any cause, but insufficient parental supervision was also identified as another important contributing factor for child injuries.

For a childhood injury prevention initiatives, participants identified several approaches including using common safety devices and putting barriers in the doors or all other exit points of the home. It was obvious from the study that supervision is very important issue for childhood injury prevention, while at the same time different communication channels could be utilized for raising community awareness involving the government authorities.

**Key findings:**

- Injury prevention is not a high priority issue among parents
- Injuries specially falls are viewed as unpredictable and unpreventable
- Young children are more vulnerable to injury
- Increased supervision, community awareness, using safety devices and putting barriers in the doors as well as other exit points of the house were suggested for injury prevention among children

### 5.4 Study IV

The study revealed a misconception in relation to falls among children which was - "falls are a sudden mishap and it can lead to terrible injury". The study also showed that boys and girls both have risks for falling but boys are more vulnerable than girls and young children aged 0-4 years are the most vulnerable group of all. Children can fall at any time at any time while they play, go to school or help parents in household tasks. Generally young children fall while they run with their friends; and they can fall when they push each other around. Children aged 0-4 years may fall from the bed; they can also fall on the floor if they face any barrier there. Boys fall from trees due to slipping or branches breaking; they can slip while trying to climb the tree. Girls commonly slip and fall in the yard and on the concrete around the tube-well while they perform household tasks. From the study it was also evident that young children (aged 0-5 years) commonly fall when their parents are absent, mostly during the morning and at noon

and they are usually alone at the time of the fall. The major causes of falls are inadequate information about the potential risks and lack of parental supervision.

For a childhood falls prevention initiative, participants identified several approaches i.e. increasing supervision or the parents appointing another person to look after their child during their absence, placing pillows and nets around the bed to protect young children from falling. Dissemination of injury prevention information in the schools and community was also suggested by the participants.

**Key findings:**

- Falls are an unpredictable event
- Boys and young children are more vulnerable
- Children can fall at any time especially while playing, going to school and helping parents
- Very young children commonly fall out of bed
- Boys commonly fall from trees and girls commonly slip and fall in the yard
- Lack of community awareness and parental supervision were identified as major risks
- Increased supervision, using safety devices and dissemination of injury prevention were identified as potential interventions

## **5.5 Study V**

Lack of supervision of the children, a hazardous environment at home and the low level of awareness about injury were identified as the major causes of childhood falls in Bangladesh. A potential framework was developed to reduce falls among rural Bangladeshi children following analysis of injury status in Bangladesh (mainly the research works done under this thesis) and an extensive literature review. This framework aims to promote seamless integration of injury prevention interventions using evidence-based practices at the population level in a wide range of settings. A COMBAT strategy has been identified for this framework, through series of workshops (Figure 4).

C: Creating safe environment

O: Organizing supervision activity

M: Mainstreaming injury prevention in school curriculum

B: Behaviour change communication

A: Active participation of local community

T: Treatment and rehabilitation



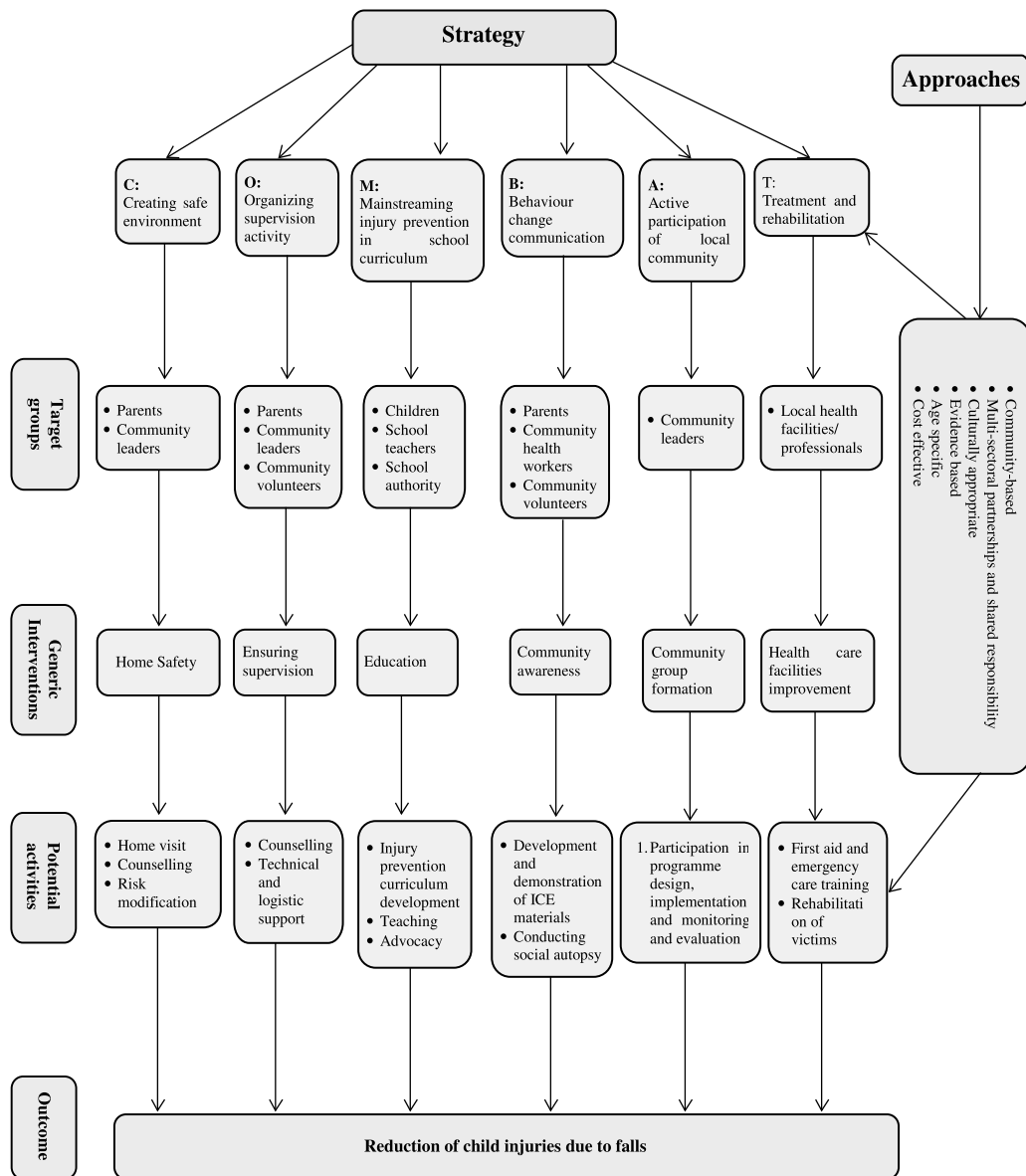


Figure 4: Framework of falls prevention for rural Bangladeshi children

According to the strategies, the following activities were proposed to address childhood falls in rural Bangladesh (Table 2):

**Table 2: Age specific key activities for childhood falls prevention under proposed framework**

Programme	Key activities for target population	Age-specific key activities			
		0-9 months	9-18 months	18 months- 5 years	5-17 years
Safety around home programme	Minimizing all identified injury risks through periodic home visit Safety counselling	Putting pillows besides the child when sleeping.	Installing door barriers  Tying ring around the waist	Tying ring around the waist	
School safety programme					Providing injury prevention information booklet as additional reading material and observe school safety day.
Community crèche				Keeping children in the crèche	
Playpen			Keeping children in the playpen		
Community awareness programme	Courtyard drama Video show	These activities are proposed for the parents and community leaders			
	Analysing social errors related to injury mortality				
Formation of community groups	Periodic meeting of the community leaders at village level				
Improve treatment and rehabilitation	Community-based first aid training Emergency trauma care training for health professionals	This activity is proposed for health care professionals and community volunteers			
	Community-based rehabilitation of the victims	These activities are proposed for the parents and community leaders, health care professionals and social organizations			
Measure of success					
Reduce incidence of childhood falls in rural Bangladesh and improved personal safety					

## **6. PROPOSED CHILDHOOD FALLS PREVENTION FRAMEWORK FOR RURAL BANGLADESH**

During the designing of the framework of childhood falls prevention, both active and passive approaches to a prevention strategy were considered. The main thrust of this framework was to eliminate falls related risks and hazards in the environments (home, school etc.), organizing supervision mechanism for young children while parents remain busy, increase community awareness and improve trauma care management. Followings are the tentatively identified activities under the framework:

### **6.1 Creating Safe Environment**

#### **6.1.1 Home Safety programme**

More than 50% of childhood falls occur in and around the home and its surroundings in Bangladesh (study-II). As part of this programme, a community health worker will visit the home in her/his assigned area every month with a checklist to identify risks and hazards in and around the home. The health worker will counsel mothers and other household occupants about the risks of childhood falls including ways of minimizing and eliminating risky conditions both inside and outside the home especially by not letting children climbing high trees. Parents will be guided about how to supervise young children. They will also be taught on safety measures for home environment, especially installing door barriers and playpens.

Height of the barrier will be needed to adjusted according to the age of the children as more than half (56.6%) of all incidents occurred from higher levels (study II). Health workers will also counsel parents, especially mothers, about the danger of keeping children sleeping alone on beds without any preventive measures in place. Health workers will advise parents to use safe beds (baby-cots-beds with barriers in all sides) for very young children. They will also demonstrate how to put pillows besides the sleeping infants. In addition, health workers will counsel parents not to allow their children walking, running or cycling on slippery roads and surfaces.

#### **6.1.2 Environmental modification**

Modification of home environment and its surroundings has been recommended as a potential intervention as home and its premises identified as the main place where childhood falls occur. Health worker will identify the possible injury risk and hazards (focusing on childhood falls) using a check-list in and around the home at the time of visiting home for home safety programme. Once injury risk and hazards are identified, health worker will work with the head of the household to address/minimise those. Health worker will check the status of injury risk and hazards every month.

### **6.2 Organising Supervision Activities**

#### **6.2.1 Community Crèche**

The majority of the injuries due to falls among children occur during the day time, when mothers are busy with their household chores; fathers are at work and older siblings are at school. Studies found that children were significantly at higher risk of falls when they remain unattended or playing without adult supervision (study- III & IV). Young children commonly fall during their parents' absence, mostly at morning and noon (study IV). There is no alternative to the mother in taking care of the children. Most of mothers remain busy with household work. Therefore, it is not easy for them to take care and monitor their children constantly.

Ensuring regular supervision was identified as a possible intervention during this most vulnerable period (study III & IV). Development of a community crèche or day care centre was identified as an alternative solution to parental supervision. Each of the community crèches will provide a safe environment to 20-25 children, aged 18 months to 5 years old. The community crèche caregivers will be the married women from the same community and aged between 18 and 35 years old. The crèche caregiver will utilize a room in her home for the crèche activities. They will be trained on safety, supervision and early childhood development (ECD), ensuring maximum safety and giving early childhood development stimulations to the children from morning to noon, six days a week.

#### 6.2.2 Playpen

To keep young children safe inside the home, the health workers will demonstrate how to prepare a playpen for keeping children in when parents are busy with their daily tasks. It has been proposed to keep 9-18 months children in playpens, whilst considering child development and breast feeding practices in rural Bangladesh

### 6.3 Mainstreaming Injury Prevention in School Curriculum

#### School safety programme

Children aged 5-8 years are the most vulnerable group for childhood falls (study II). In rural Bangladesh, children 6 years and above stay at schools most of the daytime. School is the ideal place to teach children about the risks of childhood falls and their prevention. Therefore, injury prevention booklet will be developed for the students as additional reading materials. The booklet will include information on injuries due to falls and their prevention. A first-aid course will also be included for higher grades. It is expected that children will be able to practice safety and act as a change agent in her/his family and the community in order to promote safety issues. In all schools school safety day will be observed to identify the injury risk and hazards in and around the schools; minimizing or eliminating these risks and hazards.

### 6.4 Behaviour Change Communication

#### 6.4.1 General awareness programme

In many cases it has been found that injuries occur due to lack of awareness among the parents and caregivers about risks for injury (study III & IV). To improve knowledge, create mass awareness and to change behaviours in relation to childhood falls prevention in the community, various communication strategies have been proposed including docu-drama, video-shows, courtyard meetings and distribution of booklets and posters. In the rural Bangladesh, it is often difficult to reach men during the day time due to their work commitments. Therefore, most of these activities will be organized in the afternoons or in the evenings to ensure their increased participation.

#### 6.4.2 Social autopsy programme

A social autopsy can be used to analyse social errors and to find an appropriate way to correct them [44]. It provides evidence in the form of actionable data to communities, health programmes, and health policymakers, and increases motivation at all levels to take appropriate and effective actions [45]. Social autopsy programme has been proposed following any death due to falls among children to discuss the circumstance with view of identifying socio-geographic errors related to that death and find an appropriate way to correct them. Health workers working in the respective area should take the initiative to organize this programme after discussing with family of the deceased.

## **6.5 Active Participation of Local Community**

### **Formation of community groups**

In each of the villages (geographical area comprising about 200-300 households) an Injury Prevention Committee will be formed. Local community leaders (political leaders, teachers, religious leaders, elite persons etc.) will be the committee members. Village injury prevention committees will be a voluntary institution with a remit for reviewing injury prevention activities in their community and take necessary steps at community level e.g. levelling uneven plains and roads in their community and ensuring protective railings are installed on the roofs of houses etc.

## **6.6 Treatment and Rehabilitation**

### **6.6.1 First aid and first response training**

In case of any injury or illness first aid can be the difference between life and death. Traditionally, in case of sprains people rub oil and garlic on it and try to manipulate the bones back into place if they are dislocated. However, to stop bleeding from wounds, herb paste, grass paste, kerosene or lime is applied. Only in serious cases do people take the children to the doctor. In some cases people even take their children to the 'Kabiraj' (traditional healer) and quacks. Such practices threaten to compound injury, resulting in further complications, facilitating infections, prolonging illness and contributing to permanent disabilities. So, first aid and first responder system have been proposed as part of the framework.

### **6.6.2 Improve emergency care**

Most of the health care facilities in rural Bangladesh are not well-equipped with trained care givers (doctors, nurses and technicians etc.). Long-term disability and associated complications can be minimized by providing timely and appropriate care to the victims of childhood falls. Therefore, it has been proposed to include emergency trauma care training for the health professions to build their capacity in managing injured victims. To improve trauma care facilities at all government hospitals (primary, secondary and tertiary hospitals), relevant government authorities will be advocated.

### **6.6.3 Community based rehabilitation**

Community based rehabilitation programme was considered as part of this framework since falls is a major cause of permanent and long-term disability (study II). Local injury prevention committee will take the lead for this activity. Victims will be supported physically, socially and economically as needed. Community must be involved in its planning, implementation and evaluation.

## **7. DISCUSSION**

### **Overall discussion**

Only a few studies have been conducted on the epidemiology of childhood falls in Bangladesh and most of them were carried out in hospital settings; hence failed to capture data on children in hard to reach areas who have limited access to medical care. The magnitude, pattern of occurrence and peoples' perception about childhood falls has never been studied at population level. Therefore, falls have never been addressed as one of the major health problems in relation to other illnesses among children. Because of inadequate information about the burden of childhood falls, no prevention initiatives have been designed to address this neglected and less recognized problem. The overall aim of this thesis was to generate information for formulating and developing a childhood falls prevention programme especially for rural Bangladesh. Both qualitative and quantitative methods were used in generating the required information to formulate a prevention framework.

### **7.1 Circumstance and Context**

#### **7.1.1 Vulnerability with demographic features**

In study-I children of 1-4 years of age were found to be the most vulnerable group for unintentional injuries, whereas in the study-II children aged 5-9 years were the most vulnerable for injury due to falls. Even infants had relatively high rates of falls, with subsequent serious injuries. Gender variation for the incidence of childhood falls was observed in study II. Among the male children, the rate of incidence peaked in the 5-9 years age group; among female children the highest rate of incidence was observed in 1-4 year olds and this can be explained by a greater percentage of older children being involved in high risk sports and activities. Natural curiosity, impulsiveness, less acute perception of dangerous situations and a limited ability to react promptly and properly to the risks are various reasons for the higher vulnerability of young children. However the findings from the World Report on Child Injury Prevention found that children less than one year of age have very high rates of injury in low-income and middle-income countries [15].

In study-II, it was observed that male children (68.9%) were the main victims of falls and this is consistent with other studies [46,47]. In Bangladesh when the girls grow older, they usually start helping their mothers with household chores, while boys start movement outside their homes with increase of age increases. This could explain the gender difference in falls between males and females.

#### **7.1.2 Place and time of injury occurrence**

The places that children fell from in Bangladesh were not dramatically different to any other countries. Home is the most common place for childhood falls in Bangladesh (study-II) and the findings are very much consistent with findings in many other countries [23,48,49]. For older children, homes have many fall hazards in them; stairs and roofs often lack railings, the staircases usually have non-standard pitches (heights and depths of treads), electrical extensions cords across the floor, etc. [17]. However these studies established that school, and public places etc. are the common places for injury occurrence in the case of older children. In rural Bangladesh, older girls usually help their mothers with household chores. Thus, they commonly fall on the concrete around the tube-well and yard when helping their mothers with household tasks.

Most falls occurred while children were engaged in sports and play. In Bangladesh, children who experienced injuries from falls, whether at home or outside the house, were almost always unsupervised by the parents, and were either alone or accompanied by a peer or an older sibling. Young children commonly fall during their parents' absence, mostly in the morning and at noon (study-IV). However, older children especially boys regularly fall at noon and during the afternoon, because at those times they climb trees or dive into ponds or play in other ways. After breakfast, the father goes to work, the elder brothers and sisters go to school and the mother is busy with her regular household chores. At such times children may be unsupervised and may be at increased risk for falls or other injuries.

#### 7.1.3 Socio-economic condition

Poverty, overcrowded household, unemployment of parents, single-parenthood and low maternal education were found as significant risk factors for childhood falls [50,51]. In Bangladesh too, more childhood falls were found among the poor families (study-IV).

#### 7.1.4 Parents' perceptions of unintentional injuries and their prevention

In Bangladesh, injury prevention was not identified as a high priority in parenting; mothers were mostly concerned about other health problems of their children (study-III). Parents' attitude toward childhood falls as a normal process of a child becoming an adult. Insufficient parental supervision was identified as another important contributing factor for child injuries. In our study we found that most of the child injuries occur in and around the home and its surroundings, which is consistent with other studies [48,52].

Although supervision is important in preventing injuries, watching alone does not prevent injuries. There has been no consistent research support for either supervision or parental competence in preventing injury [53]. Rural mothers, especially when at work or busy with household chores, are not in a position to supervise their children constantly [54]. Furthermore, in cases such as in a large family, constant supervision of each child is not possible. Hence, a feasible intervention for the supervision of the children needs to be identified.

While most of the participants were reluctant to consider child injuries as preventable, amazingly we observed different injury prevention measures which were unknowingly in practice in a few households. Promoting these indigenous good practices in a systemic way could also be an important strategy for the prevention of childhood injuries.

It was obvious from the study that supervision is a very important issue for childhood injury prevention, whilst at the same time different communication channels could be utilized for raising community awareness involving the government authorities.

#### 7.1.5 Children's perception about falls and its prevention

Major determinants that emerged from all interviews and discussions were lack of parental supervision, environmental conditions and demographic characteristics of the children for childhood falls (study-IV). In the study most of the children explained falls as sudden mishaps which can cause terrible injury. A study explaining children's self-reports on their behaviour in risky situations by 8-year-old children identified fate as the principal reason for the occurrence of minor injuries [55].

Similar to the previous finding, discussions and interviews revealed that boys were identified as more vulnerable than girls to falls. In the study, it was found that younger children mostly fall from beds, chairs and furniture. This is not consistent with previous studies conducted in high-income countries [56]. It was also found that older boys commonly fall from the trees

around their home environment and high places as well as in playgrounds and this is consistent with other studies. Thus, it has been recommended that the home environments should be the prime foci to prevent childhood falls [57].

As can be seen from the results, participants mentioned a number of approaches other than placing barriers for the prevention of childhood falls. Most of the participants spoke of falls prevention efforts that emphasized supervision, education and community awareness.

#### 7.1.6 Suggestion for childhood falls prevention

Children can suffer from serious injuries after falls and these may hamper their education and working abilities in the long run. Hence, primary prevention should be a central feature when considering a falls management strategy/framework. In our framework we have considered all types of injury prevention (primary, secondary and tertiary prevention). Our framework (COMBAT) focuses on most effective approaches to injury prevention which is interdisciplinary and multifaceted in nature [58]. Currently, community-based child injury prevention programmes has drawn attention as it has the scope to include strategies in addressing the problem of falls children encounter during their activities. Moreover, community-based models are characterized by having a shared ownership of the problem and its solution, and an emphasis on optimizing community involvement [59]. Hence, we aimed at community-based activities including direct participation of community leaders in our framework. Major component of our framework is creating safe environment. Literatures suggest that there is tremendous potential to reduce child injuries by making children's physical environment safe through wide implementation of strategies [58]. Organizing supervision activity has been proposed as supervision was identified in reducing child injuries though there are different opinions [60]. Most of the child injury prevention programmes emphasis on injury prevention activities in the schools [61]. In synchronization with those programmes we have proposed school safety programme as one of our strategic component. Main thrust of our framework is behaviour change communication as it is established that effective community-based injury prevention programmes are grounded in a health behaviour framework [58]. Active participation of community leaders were encouraged for self-sustainability of the programme. Bangladesh as a low-income country has financial constraints to support injury victims if the outcome is either long-term or permanent disability. Thus, we have proposed first aid and first response training programme including improvement of emergency care in all government hospitals. To enhance quality of life for people with disabilities including their active participation in the development of the society, community-based rehabilitation activities have been proposed as part of holistic approach to prevent childhood falls.

## 7.2 Strength and Weakness of the Study

### 7.2.1 Strength

Main strength of this thesis is to use mixed methodology (both quantitative and qualitative) as goal of mixed methods research is to draw on the strengths and minimize the weaknesses of both types of research [62,63]. The quantitative methods revealed the epidemiology and determinants of unintentional injuries among children as well as childhood falls in Bangladesh. Perceptions of the parents and the children about childhood falls and their prevention were explored through qualitative study methods. The framework of the childhood falls prevention programme was developed on the basis of generated information from the above mentioned studies and through series of workshops with experts.



The other strength of this thesis is the study base. A nation-wide survey was conducted to determine the magnitude, characteristics and consequences of burns. Stratified multi-stage sampling scheme generated a national sample size of 171,366 households with a population of 819,429 including 351,651 children of 0-18 years.

#### 7.2.2 Weakness

Case control method is the best approach to establish risk factors. In this thesis, we did not include any case control study. The framework was designed based on findings of the cross sectional survey and two qualitative studies. Recall period for the quantitative studies was one of the limitations of this thesis. Recall period for mortality and morbidity was one year and six months respectively. As the recall period was long, no minor data on falls was included in this study and only moderate to severe falls was included in this study. In addition, forty eight data collectors were involved in the data collection. There might be a variation in defining morbidity or there might be an inability in understanding the definition by the respondents which might cause some inaccuracy in the number of moderate morbidities.

## **8. CONCLUSIONS**

Childhood falls are a major cause of morbidity and disability in Bangladesh. A lack of awareness about the risk factors and preventive measures among the people, a low level of supervision practice for the children and hazardous environments at the home and its surroundings are major factors related to a high incidence of childhood falls in rural Bangladesh.

A framework of prevention programmes was developed considering the magnitude, determinants and people's perception about childhood falls in Bangladesh. When designing the framework, all relevant determinants including the socio-economic condition, environmental and cultural condition were considered in great detail. A literature review was undertaken in order to gain an in-depth understating of different models of injury prevention in different settings. Community participation was considered as the guiding principle in the development of the framework. For example, initially the crèche programme was limited to children between the ages of 1-4 years of age because this is the second most vulnerable group to falls because of lack of supervision. However, following feedback from the community, it was modified to include children from the ages of 1-5 years. As rural children start school from age 6, the age allowance was raised to ensure supervision until they start school.

Bangladesh like other low-income countries has financial constrains in relation to running different vertical programmes for addressing different public health problems. Furthermore, donors could be relied upon for ensuring the sustainability of the programme. Thus in designing this framework using local technology and resources which are accepted by the local people and which are affordable were strongly considered. Placement of door barriers or keeping children in a playpen using local materials and technology is not a costly intervention. Even, hanging a bell around the waist of the children for tracking her or his movement is a simple, effective and affordable means. A community-based rehabilitation programme is also a feasible and cost-effective intervention if community is involved from the beginning with cost sharing.

All of these efforts were considered to make the programme acceptable and feasible to even to the very poorest people in rural Bangladesh.

## **9. RECOMMENDATIONS**

The proposed framework to address childhood falls in rural Bangladeshi children was designed to make it feasible and acceptable to the community. A small pilot project to explore its effectiveness in terms of reduction of mortality and morbidity is recommended before implementing at national level.

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